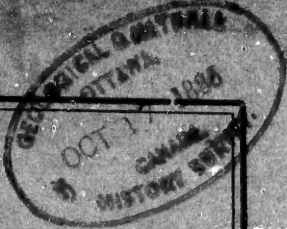


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REPORT

—OF—

CERTAIN IRON ORES

—IN—

Lanark Co., - Ont.

—ON—

Lands in the Townships of Darling and Lavant,

—TO THE PROPERTY OF—

MESSRS. WYLIE & HALL, *Ex*

—INCLUDING—

**THE REMATITE, IRON DUKE, AND
LAVANT GIANT MINES,**

MADE WITH A VIEW TO THE SUITABILITY OF THE LOCALITY FOR THE
ESTABLISHMENT OF A

CHARCOAL-SMELTING FURNACE,

—WITH—

**ESTIMATES OF THE COST OF MAKING PIG-IRON
FROM THE ORE.**

—BY—

JOHN BIRKINBINE, - - ENGINEER

*Secretary of the Am. Institute of Charcoal Iron Workers,
of Philadelphia, Pa.*

NOVEMBER 1886.

CENTRAL CANADIAN Print.

REPORT

-OF-

J. BIRKINBINE, ENGINEER.

-ON-

IRON MINES IN LANARK CO., ONTARIO.

Wm. H. WYLIE, Esq., Carleton Place, Ont.

DEAR SIR,—

The following is presented as the results of an examination which I made, in company with yourself and Mr. William Hall, of certain properties in Lanark County, Ontario, on which there were indications of iron ore; together with such estimates and other data as are believed to be serviceable to you.

The several properties visited were located as follows: (The letters of designation here given will be used throughout this communication).

A. HEMATITE. East Half of Lot 16, Fourth Concession; One Hundred Acres; Township of Darling, County of Lanark.

B. IRON DUKE. East Half of Lots 21 and 22; Fourth Concession; Two Hundred Acres. And East Half of Lot 22 in Third Concession; One Hundred Acres; Township of Darling; County of Lanark.

C. LAVANT GIANT. Lot No. 11, First Concession, Two Hundred Acres; East Half of Lot No. 11, Second Concession, One Hundred Acres; and East Half of Lot No. 12, Second Concession, One Hundred Acres. All in Township of Lavant.

All the properties are located in Timber Districts, "A" and "B" particularly.

DESCRIPTION OF PROPERTY "A."

The indications of ore were—so far as my investigations extended—confined principally to a clearing in the wooded area, but there the surface is well strewn with specular iron ore, from quite small pieces to boulders. Unfortunately no exploration other than a little surface scratching has been made; so that there is no means of determining the probable extent or character of the deposit.

Darling E 1/2 16 - IV.

do E 1/2 21
E 1/2 22 - IV
do E 1/2 22 - III

Lavant 11 - I
E 1/2 11 - II
E 1/2 12 - II

The amount of ore visible is such as may safely encourage the necessary preliminary expenditure to locate and open up the deposit ; and the ore is abundantly rich in iron, and readily smelted.

QUALITY.

The only analysis obtainable was made by Ledoux and Rickelt, New York, as follows ;

Metallic Iron,.....	.66, per cent.
Phosphorus,.....	.086 do
Titanium,.....	None.

This exhibits an excessive amount of Phosphorous, and the per centage of iron would indicate that the analysis was made from a specimen above the average in richness. *

The ore, according to the above analysis, is not suited for producing iron for steel by the acid or Bessemer process ; but not sufficiently phosphoretic to make it especially valuable for metal to be converted by the basic process. It would probably make a very fluid Foundry iron, and would work 'kindly' in the blast furnace.

Most of the ores in the Marquette and Menominee Ranges, Michigan, and those of Iron Mountain and Pilot Knob, Missouri, are specular ores ; so also is that obtained from the Rio Mine, Island of Elba.

When the Territory on which the ore is found is thoroughly examined and test openings made, it would be advisable to have thorough analyses made of the average ore so as to more thoroughly test its value.

FACILITIES OF PROPERTY "A."

A stream flows at the foot of the hill on which the ore is found, which would furnish sufficient water for a blast furnace plant ; and the wealth of timber adjacent to the property would give an ample supply of wood for manufacturing charcoal for many years.

No railroad facilities at present exist, but the topographical features are such as admit of cheap construction of wagon roads, or branches to existing railroads.

The valley of the stream above mentioned would give an easy means of reaching the property, and it is not improbable that contemplated extensions of existing lines may follow this course.

(*Ferrie oxide is composed of 70 per cent. of iron and 30 per cent. of oxygen. As this forms the base of red hematite or specular ores, seventy per cent. of metallic iron is the maximum amount which could be found in thoroughly dry, clean ore, free from any impurities.)

DESCRIPTION OF PROPERTY "B."

Although close to property "A," the property "B" is separated by ridges, heavily timbered, which it is more convenient for roads to pass around than to cross. The indications of ore on this property are distributed over a greater area, and the outcroppings are more pronounced than on property "A," some of the indications being most encouraging in appearance.

QUALITY.

The character of the ore is decidedly different from that on property "A," that on property "B" being a magnetite, and the partial analysis shown me gives indications of a superior quality, thus

Metallic Iron.....	65.81.
Phosphorus.....	0.017.
Titanium.....	None.

It is to be regretted that the Silica, Manganese, and Sulphur, were not also determined.

The sample as analysed shows an unusually low per centage of Phosphorus, and a per centage of Iron greater than the average of the Lake Superior Magnetites, and also than the ore as ordinarily won near Port Henry and at Crown Point, N. Y.

I would strongly recommend a complete analysis of the average of this ore, and a development of the deposits; for if its quality approximates the analysis given, and if it can be cheaply mined, it is of unusual value.*

FACILITIES OF PROPERTY "B."

This location is also most favorable for a supply of fuel, the tract being heavily wooded and surrounded with immense areas of timber land. Localities for blast furnaces can be found near to the ore outcrops, but it will probably be advantageous to erect such industries upon one of the Lakes convenient to the property, thus giving ample water for furnace uses, and a cheap method of bringing fuel to the plant; such localities would also offer better facilities for railroad construction to existing lines, or permit of partial water transportation.

DESCRIPTION OF PROPERTY "C."

This is located several miles South of the other properties, and presents many favorable indications. The ore

(* Magnetic Oxide, the base of Magnetic Iron ores, consists of 72.-41. per cent. of Iron and 27.-59. per cent. of Oxygen. A thoroughly dry Magnetite, free from any impurities whatever, could not therefore contain over 72. 41. per cent. of Metallic Iron.)

outcrops are of a phenomenal size, and although no analysis of the ore has been made, it may be classed among the rich magnetites. It is worthy of thorough investigation and development, and I would expect it to be of excellent quality. It is not in as heavily a timbered area as property "B," but abundance of wood is found in the vicinity; and as the ore occurs close to the Clyde River, a ready means of transporting timber to the property in the future exists.

It is probable that it will be found advantageous to locate a plant for smelting this ore on Joe's Lake (a part of the Clyde River), as I understand this body of water will float boats of considerable draught close to the Kingston & Pembroke Railroad. A wagon or train road two miles in length can readily be built to the Lake, with grade favoring the transportation of ore to the furnaces.

It is also natural to expect that railroad extensions would seek the valley of the Clyde.

COMPARISON OF DEPOSITS.

Without thorough analysis no comparison of the quality of the ores is possible, nor can an estimate of the extent of any of the deposits be made without developments.

Appearances, however, favor deposit "C" as to quantity in sight, and it is probable that this deposit can be brought into use more cheaply than either of the others. If Joe's Lake is navigable for large scows to the railroad, the location of a furnace plant here would seem most advantageous.

Next to property "C," it seems probable that property "B" would offer the best opportunities for development.

Each of the properties, however, presents sufficient inducements to encourage a thorough investigation of the quality and extent of the ore, and of the local advantages for manufacturing pig-iron.

OTHER ORES.

The ores now being mined in the country adjacent to the properties are of unusual quality, and some of them are now taken seventy-five miles to Lake Ontario by railroad, thence transported by boat to U. S. Ports, (where a duty of seventy-five cents per ton must be paid upon them), and from whence they are shipped by rail several hundred miles. Two tons of this same ore could be mined and delivered at furnaces located close to them, for less than it would cost to deliver one ton of it at U. S. Ports on Lake Ontario, and yet no effort seems to be made to utilize these ores in Canada.

COST OF MINING.

With the meagre data at hand it is impossible to estimate the cost of mining iron ores on the properties under consideration, but to allow for ordinary underground working, one

dollar and sixty cents per ton will be taken in the following estimates, and although the analysis shows a richer ore, an average of 55 per cent. only will be taken.

To allow for cost of property, development, etc., a royalty of twenty five cents per ton of ore will also be added in the estimates.

FLUX.

Unless the ores differ greatly from the partial analysis given, the proportion of flux required will not be larger, but there is an abundance of limestone convenient to the various properties.

In the estimate of cost of producing iron three-tenths of a ton of flux at \$1.50 delivered is allowed per ton of pig iron.

FUEL SUPPLY.

No mineral fuel is, as far as known, accessible for use in a blast furnace plant located in the vicinity of any of the properties; nor does it seem at all probable that it would be most profitable to ship the ore mined to locations more convenient to such supply.

This is not, however, a drawback, for the various properties are within easy reach of the best known fuel for smelting iron charcoal,—which can be delivered to an industry at rates much below the average of what similar fuel costs in the United States.

The production of charcoal pig iron in the United States has within the past five years greatly increased, as will be seen from the following statistics:

CHARCOAL IRON PRODUCED IN THE UNITED STATES.

In the Year.....	1878	1879	1880	1881	1882
Tons,.....	503,390	358,873	537,558	638,838	697,900

The per centage of increase in production of pig-iron from 1878 to 1882 was as follows:

With Anthracite Coal, ...	87 per cent.
" Bituminous "	105 "
" Charcoal,.....	133 "

Some of the furnaces using this kind of fuel can point to records of low fuel consumption or large outputs which, when compared with their size, have not been equalled by mineral fuel plants.

There is no fuel which fulfils the requirements of a blast furnace better than charcoal.

As wood is abundant and cheap, you need have no fear as to fuel supply, and the character of the timber growth will make charcoal of the best quality.

COST OF PRODUCING CHARCOAL.

In many parts of the United States where wood is by no means as plentiful, nor of as good quality as in Lanark and adjacent Counties, Charcoal is made in meilers in the woods and delivered to iron works at six cents per bushel. When kilns are used, a lower price still is often obtained; and if retorts are employed, a further reduction in cost is possible, even if the gaseous products are not utilized. To illustrate:

Our iron works have a battery of kilns located in wood, very similar to that adjacent to the locations examined, and a responsible party contracted to cut the wood, haul it to kilns, carbonize it, and deliver the charcoal in cars at four cents per bushel.

The interest and depreciation of kiln-plant would be about fifteen one-hundredths of one cent per bushel, so that an estimate of five cents per bushel would allow for cutting wood and making charcoal, the interest and depreciation of plant, as above, and pay at the rate of thirty-eight cents per cord, for stumpage or wood leave.

A close estimate lately made shows the cost of producing charcoal in retorts (where wood cost \$3 00 per cord delivered at the works) to be six and one-quarter cents per bushel, allowing 75 cents per cord for cutting, 38 cents for wood leave, and 87 cents per cord for hauling to the retorts. This would make charcoal cost you 4 $\frac{1}{4}$ cents per bushel.

An estimate of five cents per bushel will therefore appear ample for a number of years.

Charcoal pig iron has been made with from 70 to 80 bushels of charcoal, and a consumption of not less than 100 bushels is not unusual; but to allow for a possible refractory character of ore, and contingencies of operation, an average consumption of 100 bushels, is estimated for.

The bushel here used, is that adopted by "The United States Association of Charcoal Iron Workers," viz.: 2,748 cubic inches in volume, or 20 pounds in weight.

COST OF MAKING PIG IRON.

The following is believed to be ample to cover the expenses of producing one ton of pig iron with a modern plant and appliances.

Various allowances, each described in preceding pages, have been made to cover contingencies in ore, flux and fuel supply.

18 tons of ore.....	55 per cent.	
Mining.....	\$1.00	
Royalty.....	25	
Handling at furnace.....	15—\$2.00 per ton.....	\$ 3.00
Three-tenths tons of flux delivered @ 1 50 "		45
110 bushels of Charcoal, @ 5 "		5.50
Labor making iron.....		2.00
Repairs and supplies.....		50
Interest and superintendence.....		80

\$12 85

Amount carried forward from sixth page,.....	\$12 85
Add transportation to central distributing point,.....	1 00
	\$13 85
Deduct Government bonus,.....	1 50
	\$12 35

Low grades of English pig iron now command nearly \$20 per ton in Montreal; you could heretofore probably deliver first-class charcoal iron at the same point for \$20 per ton and have a good profit.

It is not to be presumed that those now supplying Canada with pig iron, will fail to contest for the market with home production, but with a duty and bonus representing \$3.50 per ton of product. I see no reason why Canadian pig iron should not be able to largely or entirely displace that now imported.

COST OF INSTALLATION.

To bring the property into use will require 1st, opening and development of mines for ore and quarries for flux; 2nd, preparing roads or tramways, connecting mines, quarries, charcoal works, present railroads and blast furnace; 3rd, constructing necessary plant of kilns, or retorts for producing charcoal, and erecting a blast furnace; 4th, constructing dwellings, stores, etc., for employees.

The initial outlay would be lessened by substituting wagon roads for tramways, and charcoal could at first be made in millers in the woods. I, however, would recommend that the most economical methods be employed at the start, as the interest on the additional capital, depreciation, etc., would be much less than the expense of using crude processes.

The following general estimates are presented for your information:

EXPLORATION.

To thoroughly explore the three properties you should provide a fund of FIVE THOUSAND DOLLARS, so as to establish with certainty the extent and character of the deposit. Part of this outlay will be returned in the value of ore taken out.

MINING EQUIPMENT.

To start a mine with compressor, rock-drills, hoisting and pumping machines, boilers, ropes, mine cars, etc., \$25,000 should be provided. It may not be necessary to spend all of this at once, but the amount named should give you a sufficient equipment to mine from ordinary workings 50 to 100 tons per day.

BLAST FURNACE.

A modern blast furnace stack, well equipped with boilers, blowing machinery, hoist, hot-blast stoves, buildings,

etc., capable of making 25 to 40 tons per day, (according to ore used), will cost about \$50,000.

CHARCOAL PLANT.

To produce 3,000 bushels of charcoal per day a plant of kilns will cost about \$12,000, with all facilities necessary. To make the same quantity in retorts an expenditure of \$25,000 will be required.

CAPITAL REQUIRED.

To properly develop and operate one of the properties I would estimate the capital required as follows:

Purchase of Mineral and Timber Land, say.....	\$10,000
Developing and equipping Mines.....	30,000
Blast Furnace.....	50,000
Tramroads, (say).....	10,000
Dwellings, Store, etc.....	20,000
Charcoal Plant (if retorts are used).....	25,000
Incidentals.....	5,000
Working Capital.....	50,000
	<u>\$200,000</u>

To earn ten per cent. on this amount with an average output of 30 tons per day, say 9,000 per year, would require a profit of but \$2.25 per ton of pig iron made.

By using cruder but more expensive methods of mining and of making charcoal, or of transportation, and by erecting a smaller furnace, you can materially reduce the capital required at the expense of manufacturing pig iron.

Dwellings for employees will prove a good paying investment.

Respectfully Submitted,

JOHN BIRKINBINE.

PHILADELPHIA, Nov. 23, 1883.



-:o APPENDIX. o:-

PHILADELPHIA, DEC. 6th, 1883.

Wm. H. Wylie Esq., Carleton Place, Ont.

Dear Sir:—

In explanation of estimates on the cost of mineral and timber lands and of tenements, store, etc., I would say :

FIRST. The valuation given for mineral and timber lands was not intended as valuation of any particular property, nor do I think a Company would wish to restrict themselves to that outlay.

The value of such lands is a matter for the buyer and seller to determine, and I purposely refrained from putting any estimate on any property.

The sum of "say \$10,000" was only used to show that the valuation of land, &c., was not overlooked, and was by no means meant to fix a limit or establish a price of land either mineral or timber.

SECOND. The estimate for tenements, store, office, building, etc., was also made on the assumption that a Company would wish to erect its own houses, etc., and the estimate was as liberal as those for other constructions.

By making no estimate which could be considered as a real valuation of lands my report is relieved of any attempt to place a property on the market; and until it was really known what properties were wanted, and how much was to be purchased, no possible valuation could be made.

Yours Respectfully,

JOHN BIRKINBINE.



On page 4.—fourth line from top, after quality, read
"AND LARGE QUANTITY."